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THE VEGETATION OF



THE NETHERLANDS ANTILLES

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Cover picture: 

Saba: Tree ferns many feet high form a closed belt at altitudes of 1,900 to 2,600 ft

Introduction

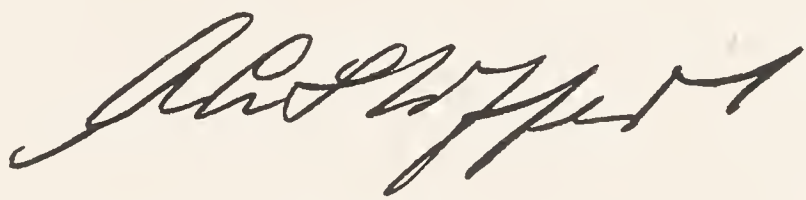
The vegetation of the Netherlands Antilles is not so luxurious as one might expect to find in a tropical region. It is, however, a misconception – often encountered unfortunately – to regard these islands as so many ‘barren rocks’ dotting the Caribbean.

In many respects there are great differences between the Windward and the Leeward Islands and this also applies to vegetation.

Because of their rather unfavourable geographic position – in the dry region of South America – and on account of the profound influence of man in the past, Aruba, Bonaire and Curaçao are rather bare, but these islands yet have their own characteristic vegetation, which is often quite beautiful.

On the Windward Islands climatic conditions are much more favourable. Moreover, topographical conditions, on Saba and St. Eustatius, in particular, have given rise to a luxurious vegetation.

In the broadcast talks collected in this booklet I have endeavoured to give an impression – necessarily a very rough one – of the vegetation of these fascinating islands in the Caribbean.



Dr. A. L. STOFFERS



Vegetation on the Leeward Islands

The Leeward Islands of the Netherlands Antilles, Aruba, Bonaire and Curaçao, are situated at a short distance from the north coast of Venezuela, a very dry area along the north coast of the South American continent between the Orinoco and Magdalena Rivers. Temperatures are very high and there is hardly any rainfall so that the area is characterized by a tropical steppe climate. Annual rainfall averages 22 inches or less, as compared with 30 inches in the Netherlands. It should be borne in mind that the high temperature makes the water evaporate very quickly so that much of it cannot be used by the plants.

Vegetation has adapted itself to these unfavourable conditions and has a xerophilous character (adapted to living in hot, dry climates). This adaptation means that generally trees and shrubs are small and have well-developed roots to enable them to absorb as much water as possible from the soil. Moreover, many of these plants have leathery leaves or they simply shed their leaves in the dry season in order to prevent loss of water. Often the stems have prickles and thorns.

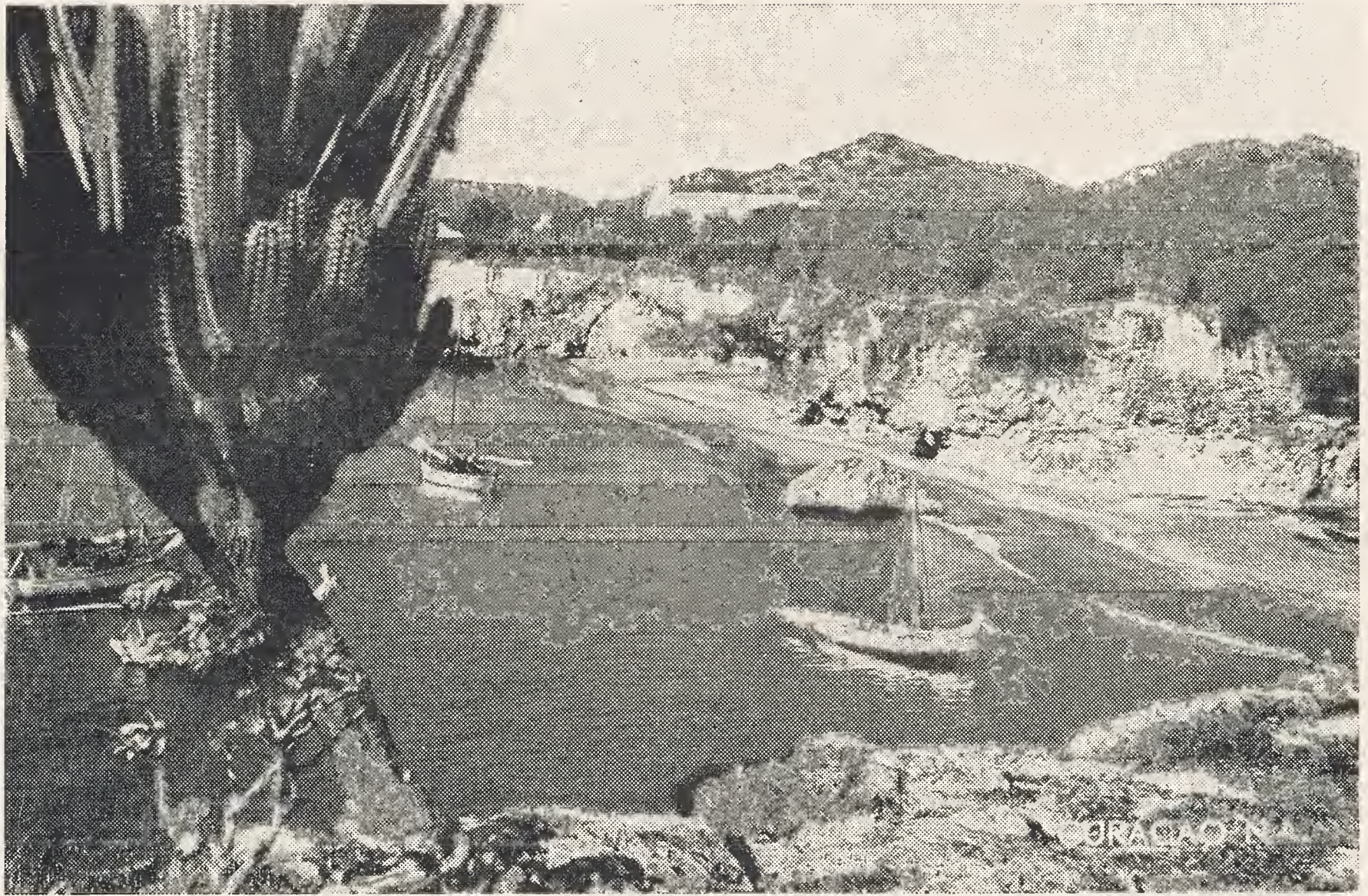
There are also plants with fleshy stems and leaves serving to store water for the dry season. Examples are the cacti, which occur on the islands in a great many shapes and varieties.

There is another group, which survives during the dry season in the form of seed. These are the annual plants which live only during the wet season. The seed germinates, the plant grows, flowers and fruits, which germinate again during the next wet season.

Although in general the quality of the soil largely determines the vegetation, this factor seems to play but an unimportant role on the Leeward Islands. The vegetation on Aruba, Bonaire and Curaçao is mainly determined by the climate. With the exception of some low-lying areas in the coastal regions, the species of plants are more or less evenly distributed over the various geological formations.

But on closer inspection it is found that there are indeed differences between the vegetation of the limestone deposits, which take up about one third of the total area of the islands, and the rest of the islands, which consists for the greater part of another rock: diabase.

There is a striking resemblance between the vegetation on the Antillean islands and that of the dry coastal area of north Venezuela, in spite of the great differences between the geological formations found in the two areas. This again shows that the climate is the most important factor determining vegetation on the Leeward Islands. However, when we look at the various species of plants we find that there



Westpunt Beach, Curaçao. In the foreground a candelabrum-shaped cactus

is a closer relationship with the other Antillean islands than with the coastal area of Venezuela.

Throughout the centuries man has had a considerable – and by no means favourable – influence on vegetation. As a result of indiscriminate cutting down of more or less valuable trees for domestic or commercial purposes (in particular Brazil wood or dye wood) or for the production of charcoal, timber stands on the Netherlands Antilles have been seriously depleted.

When vegetation disappears erosion as a result of short but heavy showers seriously increases, while on the other hand the constant trade-winds carry off the light particles of the topsoil in the dry season. In course of time large quantities of fertile soil have disappeared into the sea in this way.

By bringing various areas under cultivation man has caused much vegetation to disappear, but this does not necessarily have unfavourable consequences, provided the plantations are well looked after. But this has not always been the case. We now find large tracts of aloe on limestone deposits, and – although on a smaller scale – a small species of maize in the diabase areas. Many of these aloe plantations have been abandoned so that they are now grown over with a new kind of vegetation with much qui, indju, wild sage and lumbrá blancu.



A tecu on the slopes of Mount Christopher

In particular in the low-lying valleys we find small plantations that are sometimes artificially irrigated. They are planted with fruit-trees, such as medlar, papaw, cocoa and soursop (*anona muricata*). On these plantations we find a large variety of weeds.

Although all these things have had serious consequences for vegetation, the importation of goats has had equally devastating results. It is true, the goat provides a certain source of income for a large part of the population, but it is at the same time the greatest enemy of vegetation. In the dry season every edible green sprout is eaten by these ravenous animals which roam the islands by their thousands in a half-wild state.

It is obvious that under these unfavourable conditions, low rainfall combined with high temperatures and a great influence of man and animals, vegetation cannot be but poor. Poor indeed, but at the same time fascinating when we look at the weird candelabrum-shaped cacti and of a breath-taking beauty when we see the large clusters of orchids and the tracts of tecu on the slopes of Mount Christopher on Curaçao. The tecu, which belongs to the Bromeliaceae family (various species of which are grown in the Netherlands as indoor plants) must be considered one of the most beautiful plants of the islands. The leaves, whose colour fades from red, via yellow into green, are arranged in a close rosette in the centre of which we see the



Curaçao: the undergrowth of the forest on Mounts Christopher consists of tecu.



The 'Hofje van Fontein' (Fontein's Corner), Bonaire. An irrigated area with fruit trees; the drier parts are planted with aloe. In the background the north coast.

purple inflorescence. One may even wonder how anything can grow here, when one sees how the scattered shrubs of the grey manguel are rooted in the hard, rocky soil of the limestone table land of southern Bonaire.

The differences in vegetation are mainly caused by the topographical conditions of the areas in question. In general, there is a distinct difference between the vegetation of the northeastern slopes, which have little or no vegetation as a result of the trade-winds, and that of the southwestern slopes, which are sheltered from the prevailing winds so that there is more vegetation. But both on the northeastern and the southwestern slopes we find the same species. Obviously, there is a denser and more varied vegetation in the valleys, where the ground water is collected. But it is precisely these tracts that were brought under cultivation a long time ago and which are now generally covered by various kinds of prickly plants forming an almost impenetrable thorny undergrowth.

The richest vegetation is found on the slopes of Mount Christopher, Curaçao. The dry tropical forest can grow here thanks to a higher degree of humidity of the atmosphere and less human activity in this part of the island. It is what is known as a seasonal forest. This kind of forest grows in areas where dry and wet seasons alternate and where during some months rainfall is less than one inch. It may be compared with the forests of the low-lying areas of the other Leeward Islands to the north. But it is quite different from the luxurious tropical rain-forests in areas with much rainfall.

The treetops are, as a rule, not higher than 18 feet with here and there a few higher trees, such as the palu di sia. In many places the earth is covered with tecu,

a species of the Bromeliaceae I have just mentioned. There are many different trees, shrubs and weeds. There are various plants which on Curaçao only grow here. There are many epiphytes (plants growing on other plants) such as orchids, especially a species with bright white flowers and another species with purple flowers, the banana shimaron, further three species of the genus *Tillandsia* (Bromeliaceae); woody lianas are no exception here.

There are reasons for supposing that this type of forest was more widespread in the past. In the areas where the trees were cut down indiscriminately a new kind of vegetation has grown up, mainly consisting of fast growing plants which were, moreover, well adapted to the dry conditions.

Starting from this type of forest it is possible to distinguish a whole series of different types of vegetation demonstrating the degradation of vegetation ending in a desert-like landscape.

It is also interesting to note the great differences between the dry and wet seasons, which give the island a completely different appearance. Already a few weeks after the end of the wet season trees and shrubs are covered by a coating of dust, particles of the dried-up topsoil carried off by the trade-winds. But as soon as the first showers come, the green colour re-appears and the landscape looks fresh again. We may quote Mr. Rijkens, who wrote in 1907: 'The bare hills and rocks, the fields covered with withered maize stubbles and opuntia, the leafless trees in the hedges, the stubborn cacti with their formidable spines, all these together form a landscape which is bleak and melancholy beyond description, and one really wonders if this is the same land which, only a few months ago, was so pretty.' And we must quote Dr. Westermann's words to answer this question: 'But even in the dry season our islands have enough to offer naturalists in respect of plants and other things to make it worth-while for them to set out exploring.'

30.6.'59

Vegetation on Aruba, Bonaire and Curaçao

We have already seen that the dry conditions on the Leeward Islands of the Netherlands Antilles determine the type of vegetation found, and that the way in which man has interfered with vegetation in the past is still visible today. Perhaps the forests on and in the neighbourhood of Mount Christopher in Curaçao have more or less preserved their original state. We find there tropical forests of a dry type, in which particularly the orchids and Tillandsias in the trees and the *tecu* on the ground are prominent.

During one of my excursions I counted 58 orchids on one branch, and realising that there are hundreds of such branches we may get an idea of the wealth of orchids in this region.

Presumably, this forest had a much wider distribution in the past than it has now. It may also have occurred on Aruba and Bonaire. If we read the history of Aruba and Bonaire we find that Alonso de Ojeda, who left Cadiz in 1502 with instructions to bring Curaçao under Spanish rule, had to hide with his men in the woods. And de Laet writes about Bonaire in 1625: 'there was plenty of redwood'. This 'redwood', also called Brazil wood or dye wood, seems to have occurred on the island in large quantities. In 1690, for instance, the managers of the Dutch West India Company forbade to cut down the dye wood around the fortress since it might be very useful in the case of enemy attacks.

The trees, which immediately catch the eye because of their fantastically shaped and twisted trunks and their bright yellow flowers which begin to appear soon after the first rains, provided in the days of the West India Company a very popular kind of wood, which was crushed to extract the red dye. This crushing or rasping was done among other places in Amsterdam in what is still known as the 'Rasp House' (a prison where criminals were made to do this disagreeable and unhealthy work). This dye wood is still abundant on the islands, in particular in the limestone region.

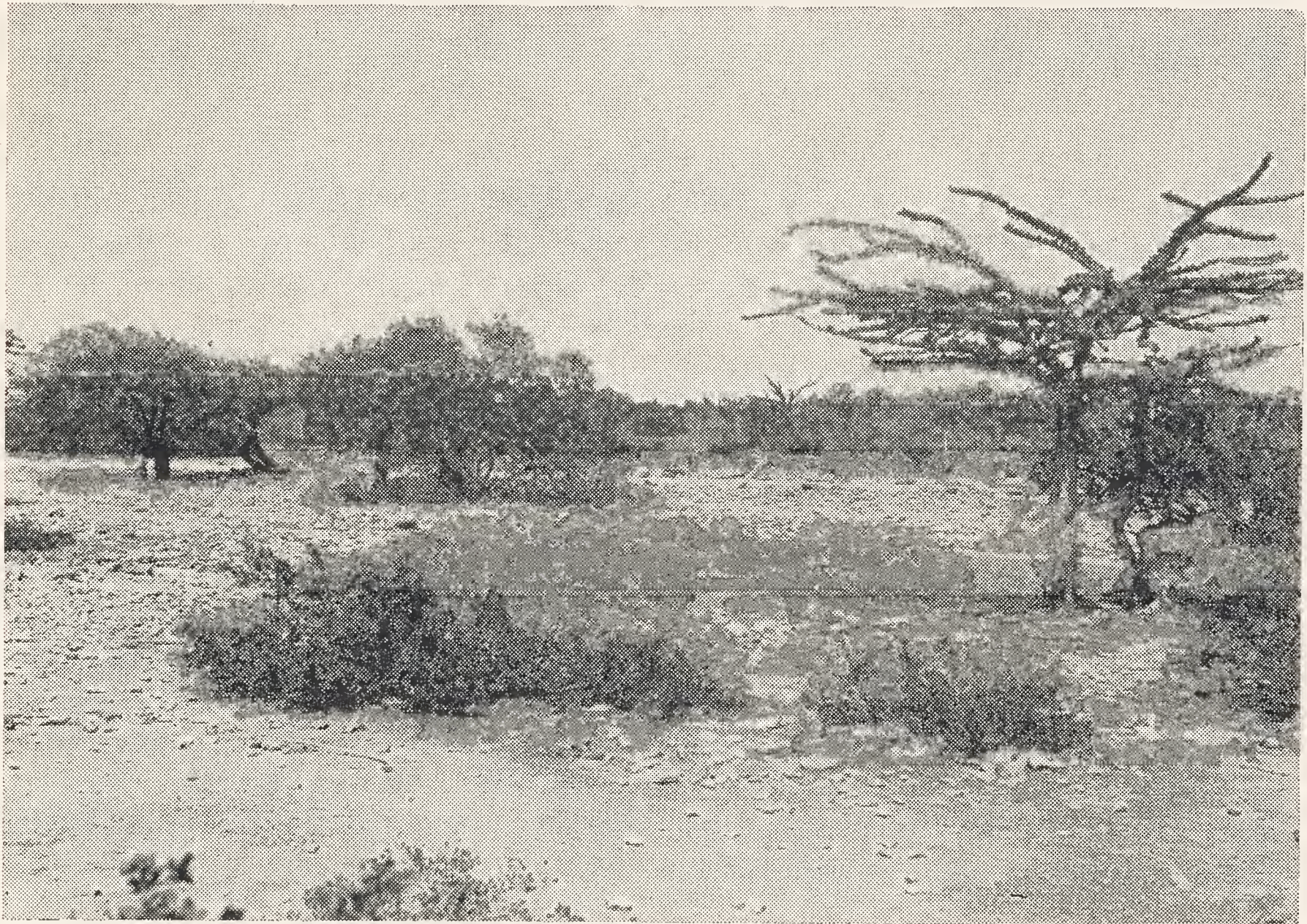
In addition to the cutting down of trees for dye wood – we know, for instance, that in 1816 400,000 kilograms of dye wood were cut on Bonaire – large tracts of forest were cut down in order to lay out indigo and sugar cane plantations. This was possible since Curaçao was an important centre for the slave trade so that there was enough cheap labour to work the plantations. But after the abolition of slavery most plantations were no longer profitable. They were abandoned by their owners and a new kind of vegetation sprang up. But in most cases the good fertile soil had disappeared as a result of injudicious use of the soil, which greatly influenced the new vegetation. Under the most favourable conditions an impenetrable thorny under-

growth sprang up; if conditions were not favourable no new vegetation grew up and the land remained barren and desert-like.

So we see here a series, beginning with this thorny woodland in which the spiny waki and indju and the dividivi are the most important trees, and ending with a bare desert-like landscape. Wabi and dividivi trees both belong to the Mimosaceae. They are cut down because the wood is excellently suited for producing charcoal. Especially the wabi tree has adapted itself very well to the dry conditions by means of its well-developed roots. The dividivi tree is, or rather was, the most valuable tree of this vegetation. It belongs to the Papilionaceae. The white fragrant flowers grow in dense clusters and secrete much nectar which attracts many hummingbirds. The fruits contain tannic acid, which was used in the tanning industry. Therefore, the exportation of dividivi beans used to form a considerable source of income of the population.

This woodland occurs almost everywhere in the islands and where it is densest the top of the shrubs and trees are closely intertwined about 12 feet above the ground.

Pool (tanki) on the low limestone plateau of South Bonaire – with Calabash tree, Conocarpus shrubs and a number of redwood trees in the background





Thorny brushwood with candelabrum-shaped cacti covers large areas of Aruba, Bonaire and Curaçao

Only a few taller trees and candelabrum-shaped cacti show above the tops of the shrubs and trees of the undergrowth. Of these taller trees the kibrahacha with its large yellow flowers is certainly the most beautiful. This tree has no leaves during the dry season and the flowers appear before the new leaves, so that when it is in bloom it immediately catches the eye as a yellow spot in the landscape. Sometimes these trees occur in large numbers close together, giving the hillsides a yellow colour, for instance the slopes of Seru Grandi on Bonaire.

The second group of the series is characterized by small shrubs and this kind of vegetation is often called Croton vegetation because of the large numbers of *Croton flavens*, the wild sage. There are only few trees, mainly dividivi, indju and wabi trees. Since these trees are not protected against the prevailing trade-winds, their tops are often flattened and elongated. These are the so-called wind trees which, together with cacti, are characteristic of the appearance of the Leeward Islands. Sometimes the shrubs are overgrown by climbers and trailing plants among which we find colourful Papilionaceae and, in particular, the brilliant passion flower. In other places the shrubs are hidden behind a curtain of the large purple-white flowers of the yerba di glas, a species of the *Ipomoea* genus.

The Croton vegetation is found on both diabase and limestone. In the latter case,



Bonaire: 'Put Bronswinkel', a pool forming a small oasis in the dry land of North Bonaire

however, there are more globular cacti, which occur here in many different shapes. There are so many different shapes that Valckenier Suringar, the botanist, believed he had counted no fewer than one hundred different varieties on the Leeward Islands. Moreover, we find here fairly large quantities of the dreaded bringamosa, a small plant with beautiful white flowers but also with stinging hairs that are much more venomous than the worst stinging nettles in the Netherlands. In more sheltered spots, especially along limestone ridges, one sometimes finds *Mammillaria simplex*, a very rare globular cactus, which is known to occur only on Curaçao and in a certain part of Venezuela.

The third group is formed by brushwood consisting of cacti, mainly disk-shaped cacti and candelabrum-shaped cacti. Apart from an isolated tree here and there, there are no other plants. Especially when there are many disk-shaped cacti, the brushwood is impenetrable. With the help of a machete, a kind of chopping knife, it is indeed possible to cut a path, but one often forgets that every chopped-off part of a cactus again forms roots, thus making the brushwood even more impenetrable. These cacti have large yellow or pink flowers and they fit into the landscape very well since they combine beauty and thorns. Can this be the reason why they are popularly called 'Spanish lady'?



Cactus thickets are characteristic of the Leeward Islands

The fourth and most degenerated group grows in the semi-deserts, which are mainly found along the north and northeastern coasts of the islands. Not only because the topsoil has disappeared so that the hard, unweathered diabase or the rocky limestone deposits form the soil here, but also as a result of the strong winds only an isolated shrub or cactus succeeds in holding its own. But as everywhere else in the islands the first showers bring forth scores of different types of grass and other herbs, among which the angló, a tiny little plant with golden flowers, often growing in groups and forming colourful patches in the brown or grey land. Curiously enough we find in this desert-like area of Aruba the cadushi di culebra, a twining cactus,



Aruba, the northern coasts of the Leeward Islands are bare; only an isolated shrub or cactus can grow here

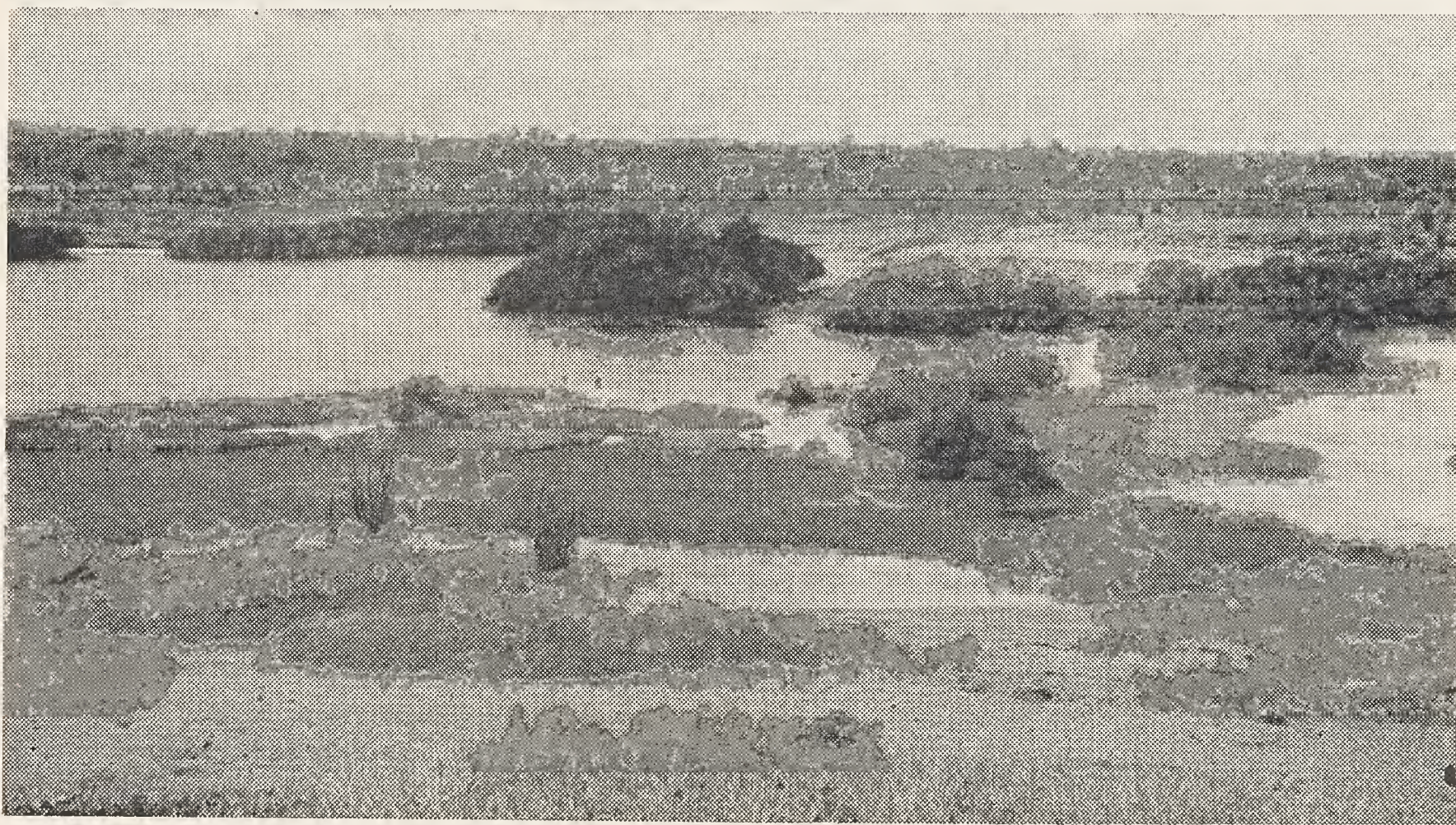
which also occurs on Curaçao but only among the luxurious vegetation on the slopes of Mount Christopher.

The lower coastal plains, the banks of the numerous inland bays and the salt plains or salinas present a different picture. There are hardly any sandy beaches since the limestone table-lands, which generally form the coasts of the islands, rise sheer from the sea. Aruba forms an exception in this respect. Here we find beautiful sandy beaches, in particular Palm Beach and Pova Beach, where the tropical effect is even increased by the waving palm trees of the coconut plantations. Along the high-water line we find the creeping *Ipomoea pes-caprae* with its purple-white flowers, belonging



The waving palms of Pova Beach

*Western part of the Lagoon. A narrow, deep bay, fringed with mangroves and muddy flats with plants loving salt (*Batis maritima*)*



to the family of the Convolvulaceae. Together with the banana di rif and some other tropical plants it is one of the first plants you meet when you travel inland from the sea. Beyond these plants we find a belt of short shrubs, the most important of which is the tabacu di piscador with rough leaves covered with silvery hairs. Only in a few places is this belt again followed by brushwood of tall shrubs and short trees, consisting mainly of 'zeedreifi', a plant which occurs only in the Caribbean area.

Just as in other tropical areas we find mangrove belts along a number of inland bays. These trees with their weird long stilt roots stand partly in the water and are of great value in reclaiming coast land. The most important species, the manguel, has adapted itself particularly well to its muddy habitat. It does not shed its fruits when they are ripe, but the seeds germinate on the parent tree and it is a very strange sight to see these young plants which are often more than a foot long, hanging on the branches. After some time the young plants detach themselves from the parent tree and land in the mud in an upright position, after which they continue to develop into full-grown trees. There are beautiful examples along the Lac on Bonaire and in the Spanish Lagoon on Aruba.

The sparse vegetation of the salt plains consists of what are known as halophytes or saline plants, which can not only tolerate the high concentration of salt in the soil but even need a saline soil. The salinas, salt plains, are as a rule bare wastes glittering in the sunshine as a result of the salt crystals at the surface. Only a few plants are capable of growing here, for instance Salicornia, a kind of glasswort, closely related to the one we find along the coasts of western Europe.

Characteristic of the Antillean islands are the clusters of Manzanilla, an ever-green with dark leaves, which nearly always grows in groups. The fruits are like green little apples and are very poisonous. But that is not all. The tree also contains a kind of sap which causes large blisters when touched by the human skin. The poison is so strong that one may even get these blisters by simply taking shelter under the tree when it rains. Both as a result of the fruits and of the sap many a visitor to the islands retains less happy memories of these trees.

The Leeward Islands present more or less the same aspect as far as their vegetation is concerned, but the Windward Islands, St. Maarten, Saba and St. Eustatius, differ greatly in this respect. These differences are the result of contrasting geological and climatic conditions.

22.3.'60

Vegetation on the Windward Islands of the Netherlands Antilles

Northwest of Curaçao, at a distance of nearly 600 miles, there are three islands that belong to the Netherlands Antilles: St. Maarten, Saba and St. Eustatius, which, together, form what are generally known as the islands of the Windward Group. They are part of the Antilles, that garland of larger and smaller islands which more or less connect Florida with Venezuela.

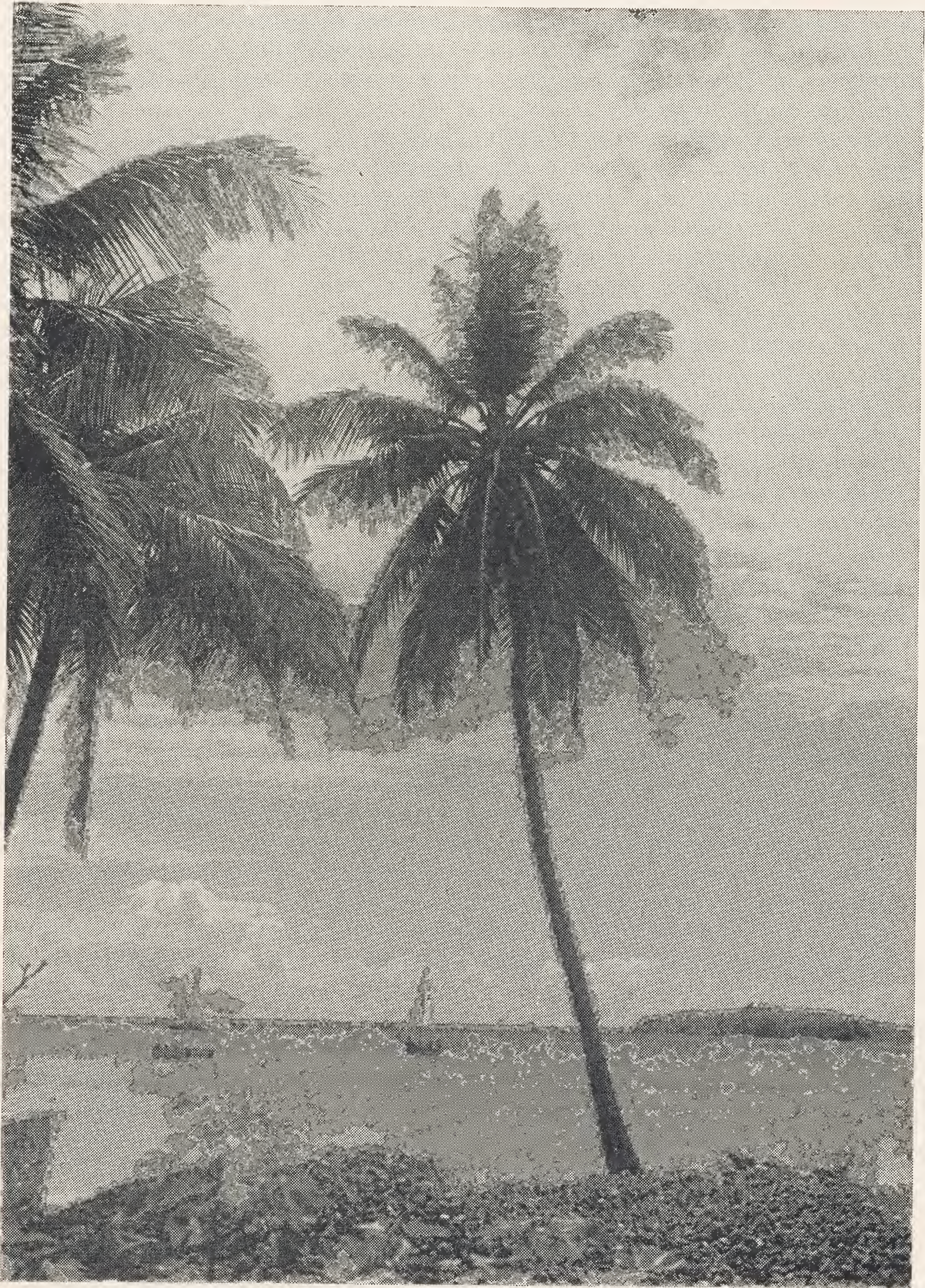
Both geologically and as regards climate the Windward Islands differ greatly from the Leeward Islands, so that it will not surprise us that the vegetation, too, shows many contrasts. If we look at the various species that grow in the two groups of islands, we discover many similarities, but if we look at the vegetation in general we find many differences.

Another important aspect is that although there is but little difference between the vegetation of Aruba, Bonaire and Curaçao, the differences between the vegetation of the three Windward Islands are considerable, in spite of the fact the latter lie close together. The greatest distance between two of the three islands, between St. Maarten and St. Eustatius, being only 40 miles.

The Lesser Antilles, to which the islands belong, consist of a so-called inner arch and, more to the east, an outer arch. The islands of the inner arch, to which Saba and St. Eustatius belong, are characterized by volcanoes of comparatively recent date, i.e. they are not older than about 10 million years. Therefore these islands sometimes rise sheer from the sea to a considerable height. The islands of the outer arch, to which St. Maarten belongs have no volcanoes. They are much older and are as a rule flat or hilly.

This is the fundamental reason for the difference between the vegetation of Saba and St. Eustatius on the one hand and of St. Maarten on the other. As a result of the differences in altitude, there are belts of different relative humidity varying from dry in the lower regions to very humid near the top. It will be clear that the humid belts are not found on the flat islands.

Let us first look at St. Maarten more closely. When we travel to the island by air the first impression is characteristic. We are tempted to believe that the island is half submerged because in many places the sea penetrates far inland. In fact, this is not far beside the truth for St. Maarten and the neighbouring islands of Anguilla and St. Barthélemy lie on a table land which is only 100 feet under the surface of the sea. During the glacial period these islets formed one great island, which is sometimes called 'Greater St. Maarten'. As a result of the fact that the sea level rose



St. Maarten. Bay with Fort Amsterdam

after the glacial period, large tracts of this Greater St. Maarten disappeared; there are no fewer than thirty-two larger or smaller bays and inlets. Often the larger inlets have been closed off from the sea by a comparatively young sand wall. The bay thus closed off is then used as a salt pan.

Nowadays St. Maarten is but a small island, its area is only 14 sq. miles. Only the southern half belongs to the Netherlands Antilles, the northern part is French. About two thirds are hilly. The hills mainly lie in two more or less parallel ridges, the eastern ridge running immediately along the coast. The plain between the two ridges is divided by a low elevation. One part is called Princess Quarter, the other Cul-de-Sac. These valleys descend in a gentle slope towards the sea. When they reach the sea they form fine sandy beaches where we find a beautiful beach vegetation.

In all tropical areas the types of beach vegetation are more or less alike. When going inland from the shore we first come across a convolvulus (of the genus *Ipomaea*) along the highwater mark and the sea pea of the family of the Papilionaceae. These creeping plants hold the sand together, just as the beach grass in the Netherlands holds the sand dunes together. This belt, which is as a rule but very narrow, is followed by a belt of shrubs mainly consisting of sea purslane. This shrub is characteristic of the Caribbean area. In a number of places coastal forest develops behind these shrubs. In the West Indian area this forest consists mainly of sea grape, a tree which, like some others, only occurs in the Caribbean area. The tree owes its name to its fruits which bear some resemblance to grapes. It is rather conspicuous because of its large, leathery leaves, which are able to resist the influence of the salt carried inland by the wind. These trees are mainly found on sandy beaches.

There is another vegetation especially found along muddy bays: the mangrove forests. In particular the genuine mangrove has adapted itself very well to the place where it grows by developing an intricate system of weirdly shaped stilt roots which it sends down from its branches, thus preventing the tree from dying in case of floods. These roots retain vegetable matter and gradually convert swamps into solid ground. On the landward side of the mangroves we often find a vegetation of weeds of which the glasswort (*Salicornia*), which we also find in the Netherlands, is the most important. Sometimes large tracts are covered by this plant.

The coastal vegetation is independent of the amount of annual rainfall, it is determined only by the soil. But the vegetation outside the coastal area depends on the amount of rain.

Compared with the Leeward Islands St. Maarten gets much rain: 44 inches per year as against 22 inches on Curaçao. This rainfall is enough to maintain a dense tropical forest. But it is not only the total amount of rain that is important, equally important is the distribution over the year. Investigations have shown that a tropical rain forest can develop only if there are at least 4 inches of rain every month. It has been found that St. Maarten has eight months in which rainfall is less than 4 inches, so that we may safely say that there have never been tropical rain forests on the island. On Saba and St. Eustatius the situation is different: the islands are higher and therefore have a greater humidity. The woods we find on St. Maarten belong to what are

known as seasonal woods, which have adapted themselves to the less favourable conditions during part of the year.

These woods only occur on the highest hills of the island. In the second half of the seventeenth century a large part of St. Maarten was planted with sugar-cane and as late as the beginning of the nineteenth century some hills were covered with sugar-cane as far as the very top. But in the beginning of the twentieth century sugar-cane disappeared and was substituted by cotton and food crops. After having flourished between 1909 and 1919 cotton, too, disappeared. There has never been any growing of sisal on St. Maarten, although an occasional sisal plant is found here and there. But even these plants have run wild. Agriculture suffered a serious setback as a result of the advent of the oil industry on the Leeward Islands, which attracted large numbers of workers from this island. But stock-breeding still constitutes an important source of income.

To the extent to which they are not used as pastures, the valleys of St. Maarten are for the greater part covered by thorny bush, among which we find many species of acacia trees. There are of course also cacti of which one species of the genus *Opuntia* is predominant. In more humid places, where the rainwater is temporarily collected after showers, we find dense brushwood consisting of a great variety of shrubs and trees, for instance, West Indian cherry, white cedar, and the typical centee-pee-plant, whose leaves are very prickly. We do not find this vegetation along the east coast with its prevailing trade winds, which carry much salt inland. The vegetation mainly consists of globular cacti, of which many varieties and shapes are found here.

In the higher regions of the island we see differences that are, in particular, determined by topographic conditions. For instance, along the sea-side of the eastern range of hills we find a dense vegetation among which there are many specimens of the black willow, a small tree with sturdy leathery leaves, which it has developed in the process of adapting itself to the prevailing winds. Higher up the slopes of the hills we find other trees with thinner and generally also smaller leaves. These trees are less suited to dry conditions and are called tropophytes.

If we descend along the slopes of the hill on the leeward side we soon reach either the pastures or the brushwood with acacia trees.

The oldest forest is found on the highest top of the western range of hills, called Sentry Hill. There are dozens of different trees, many of which shed their leaves in the dry season, a phenomenon characteristic of seasonal forests. Among them we find tall thick trees such as locust trees, redwood and gum trees. Especially the latter present a striking spectacle with their reddish-brown trunks, the outer layer of the bark continuously peeling off, just as in the case of birch trees. A very beautiful tree is the white frangepan, which is found here in large numbers. It is a small tree, which makes a very wispy impression as a result of its outstretched branches with, at the very end of these branches, long and narrow leaves. The tree carries an abundance of bright white flowers in large clusters nearly all the year round.

There are but few orchids but on the other hand there are many epiphytic plants, i.e. plants growing on other plants, e.g. Bromeliaceae. There are no cacti since it is

rather humid at this altitude. It often happens that it rains here whereas 160 feet further down the slope it is dry. At the side of Cul-de-Sac there are pastures below the forest. These pastures cover the entire hill. Cul-de-Sac is no doubt the most fertile part of St. Maarten and at the same time the most picturesque because a number of plots are separated from each other by bougainvillea, forming red, white or purple hedges when they are in flower.

The part west of the main island presents a different picture. It is flat and consists mainly of limestone. It is called the Low Lands. Only a small part of it has been brought under cultivation, the rest is covered with a more or less original vegetation. Here we do not find the acacias, which occur in such large quantities in the other low-lying parts of the island, but a large number of different trees and shrubs, which have for the greater part small hard leaves and which thrive best on limestone soil.

I already told you that half of the island is French. Of course vegetation takes no heed of man-made frontiers. Yet it is very easy to see on St. Maarten whether one is on the Dutch or the French side of the frontier. As a result of the fact that the French Antilles are not as prosperous as the Netherlands Antilles, which have profited by the oil industry, agriculture occupies an important place in the French part of the island. With the exception of the highest hill tops, the whole of the French territory is covered by arable land and pastures. The lower hills have been brought under cultivation, even their tops. It will be clear that this makes the danger of soil erosion acute.

Summarizing we may say that the original vegetation of St. Maarten has virtually disappeared, with the exception only of the vegetation on the higher parts, which could not be brought under cultivation. As a result of the dry spells the secondary vegetation mainly consists of thorny brushwood.

The two other islands of the Windward Islands, Saba and St. Eustatius – although partly similar to St. Maarten – present a very different picture.

12.4.'60

The Vegetation of Saba

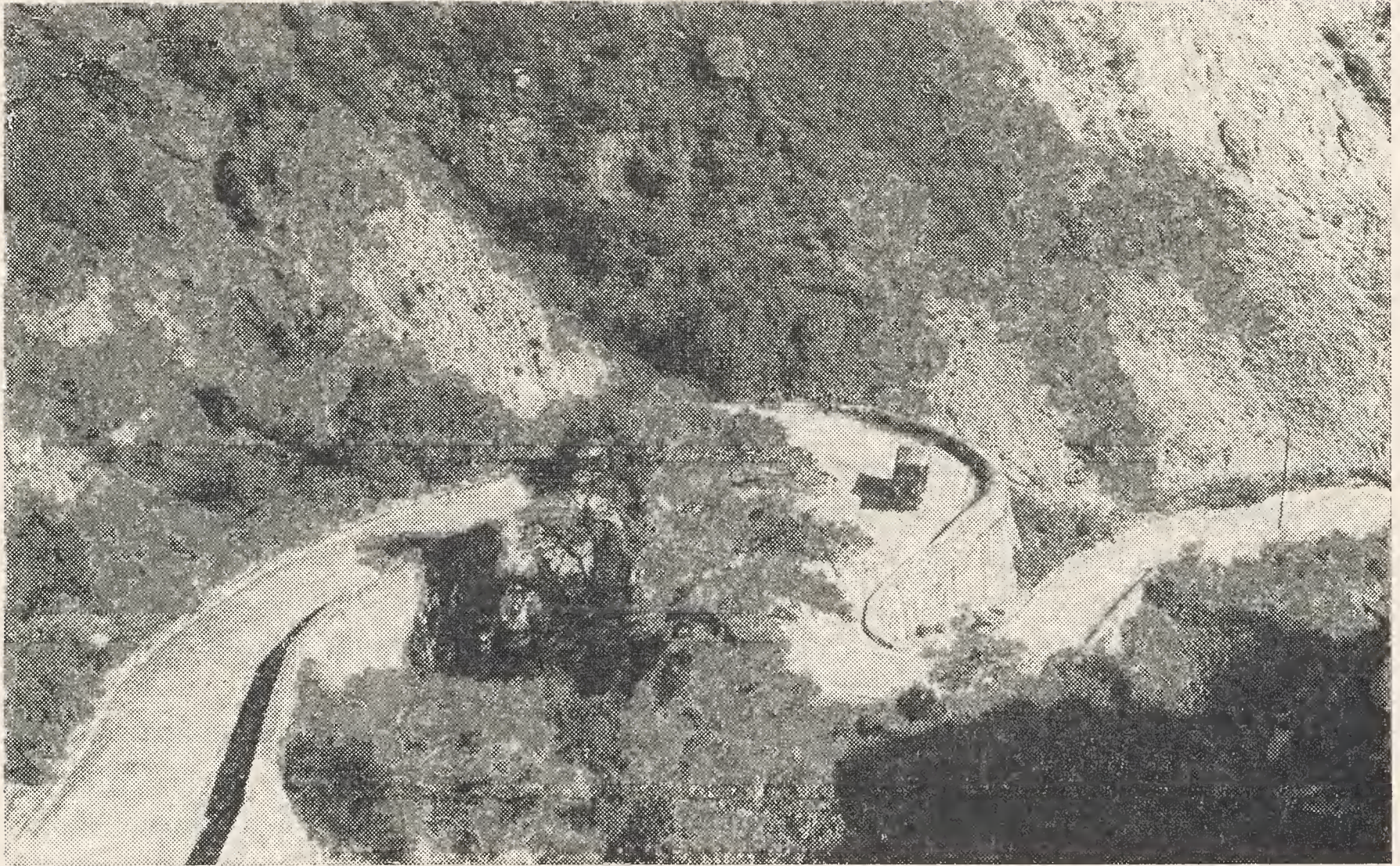
Saba is no doubt the island of the Netherlands Antilles most lavishly endowed with natural beauty. It is one of the islands stretching in a large curve between Florida and the northeastern tip of Venezuela and it belongs to the group consisting of young volcanic formations, i.e. formations less than a million years old. Saba is only one volcano, or better still, it is the upper part of a volcano, the basis of which rests on the seabed at a depth of over 1,980 ft and the top of which rises about 2,800 ft above the level of the sea.

The altitude is of great importance to the vegetation of the island, which will be clear if it is borne in mind that the greater the height the lower the average temperature will be. As a result plants may be found in the tropics at great heights which, properly speaking, belong to the temperate zone. There are more special features, however. The northeasterly trade-winds are compelled to rise on the windward side of the island and the air will therefore cool down. The water vapour then begins to condense and clouds are formed; at a given moment these will cause showers. In this way belts with different rainfall are formed; these may vary from dry belts in the lower regions of the island to belts with much rainfall at the top. We find therefore a large variety of climatic conditions on this small island, which gives rise to an equally varied vegetation.

In the course of the 18th century a large part of the island was brought under cultivation and chiefly planted with sugar cane. These cultures have now again disappeared and the original jungle is trying to regain its hold. Contrary to what we see on the Leeward Islands these cultures have done less harm here because only few parts of the island have little or no vegetation at all. These parts are mainly the perpendicular rocks and sheer precipices in the lower region, which are only sparsely covered with vegetation because of the unfavourable influence of the wind.

The first impression one gets of the island on approaching it, say, from the neighbouring island of St. Eustatius, is that of a huge rock. The island is only about three miles long and $2\frac{1}{2}$ miles wide, but it rises 2,800 ft above sea level. As a rule the top is hidden in a dense canopy of cloud, a phenomenon we often find on oceanic islands for the reason described above.

After this first impression the deep ravines soon strike us; these are mainly found in the lower regions, below heights of 800 ft or so. These ravines are called 'guts'. They are separated by sharp ridges and are due to erosion caused by the rains. In the higher regions and along the north and west coasts of the island these ravines are less conspicuous because of the luxuriant vegetation.



Saba: The road to Fort Bay

Because the slopes of the island are very steep and stretch to far below sea level Saba has no flat coasts. Moreover, the breakers have undermined the coast as a result of which it has crumbled, so that precipitous cliffs many dozens of feet high rise sheer from the sea. This is a serious thing because it shows that the sea is gaining ground as a result of erosion. The island is therefore doomed to vanish if no cataclysmic changes in the form of volcanic eruptions take place. This will take many thousands of years, however. As a result of the steep coasts there is no beach vegetation, which, for an island, is surely a remarkable fact!

We can go ashore on Saba only in two places, namely on the south coast near Fort Bay and on the west coast near Ladder Bay. In both cases we must climb over 650 ft to reach the chief town The Bottom. But what a difference there is between the ascent from Fort Bay and that from Ladder Bay!

From Fort Bay we generally travel by jeep and the road goes through a deep ravine very steep in places, lying in one of the most arid parts of the island. The vegetation on the slopes of this ravine is sparse and consists mainly of wild sage, which is also abundant on the Leeward Islands as we saw in one of the earlier chapters. The shrubs are interspersed with disc-shaped, candelabrum-shaped and globular cacti, and only a few, often misshapen, trees are to be seen. In places sheltered from the wind such trees and also tall shrubs may reach considerable proportions and then they strike the observer as dark green spots against the background of the grey slopes.

From The Bottom the road winds along St. John's Hill to the eastern side of the island, where, climbing the ridges and descending down the guts, it leads towards Windwardside, the second largest town on Saba. Here, too, the road runs through arid tracts and the vegetation differs little from that near Fort Bay.

How different a face the island presents when we go ashore at Ladder Bay. Here the jeep is no use and we must climb the more than 550 steps cut into the slope. The climb is a strenuous one but it is certainly worth while if one can appreciate the forest-like vegetation in which the fragrant wild guava, the tamarind and the white cedar with its pink blossoms abound, whilst in places the green vegetation is dotted with the scarlet flames of a flowering flamboyant.

Over 500 ft the influence of man can be clearly perceived, for here the fruit trees begin to predominate, mainly mangoes, skop apples and avocados. The ground is covered with a large variety of different weeds which present a riot of colours.

Then we arrive at The Bottom. The usually white and well-kept cottages are peeping picturesquely from among the many brightly flowering shrubs, whilst in most gardens we find tall coconut trees. The roads are flanked with low walls overgrown with many species of fern and herb and abundant lichens.

Towards the east we see a section of the road winding towards Windwardside but we now strike into a narrow path first leading through a grove of mangoes, which suddenly begins to climb steeply. It now runs through a dense forest which shows unmistakable evidence of the earlier cultures the extent of which we cannot, even approximately, guess. Examples are an occasional coffee shrub or cocoa tree or, much clearer still, large stands of hogplum, shrubs with strong leaves and large swollen fruit characteristic of the secondary vegetation in the more humid areas which form when plantations are being abandoned. Along the path we regularly see the plantain, a plant frequently met with in Europe growing along roads.

Then we suddenly arrive at one of the two flat areas of Saba: Lesser Rendez-Vous and, after having climbed another 160 ft, Greater Rendez-Vous. These two flat areas constitute Saba's agricultural region, where the delicious tannias, tomatoes and even potatoes are grown. It will be clear that there is not much natural vegetation here, but there are many and interesting weeds. The scattered, often big, boulders are overgrown with a creeping species of arum lily having leaves over three feet long and nearly three feet wide: *Anthurium giganteum*.

Above this region the plant lover's El Dorado begins. Once there was a tropical rain forest here which had to yield to the cultures. But these have disappeared as well and the forest is gaining ground again. Pioneering shrubs and rapidly growing trees are forming a dense vegetation now, among which we may find oranges, soursops, plums and avocados, the last remnants of the earlier cultures. Scores of different species of vegetation are forming *new* forest now, which is sure to develop again into a tropical rain forest if man does not interfere. Ten different species of orchid are found on the trees in addition to a number of Bromeliaceae, chiefly of the *Tillandsia* genus.

Tropical rain forest is still found on Saba but is confined to a number of ravines that are so steep or so difficult of access that they cannot be brought under cultivation.



Saba: The road to Ladder Bay

And then, suddenly, a few yards further on, there is a complete change. The forest is replaced by a forest of tree ferns averaging about 13 ft in height. The stem of these ferns is often 8 inches in diameter, clearly showing the marks of leaves that have fallen off. The leaves are implanted at the top of the stem and form flat spreading crowns. The ferns are so crowded together that we may find four or five crowns on top of each other. As a result it is very dark in this forest and no other vegetation is found there. Along the path and in the more open spaces we come across many begonias and anthuriums, however.

As I have already said, the transition from the secondary rain forest to the fern forest is an abrupt one. This is probably because this part is regularly enveloped in cloud. It is an established fact, however, that the vegetation of tree ferns is not original but developed after the virgin forest had been cut down.

The vegetation changes again as we climb higher. The tree ferns begin to dwindle in numbers and we see scattered palms. This is a transition to a type of rain forest in which palms called mountain cabbages are beginning to predominate. The vegetation is original here and characteristic of steep slopes where landslides occur. The trees are about 43 ft high, reaching 66 ft in places. In addition to the palms other trees

occur, but shrubs are absent. There are many herbs, however, interspersed with many ferns.

We still have not reached the summit. At 2,640 ft we first pass a depression in the ground which some investigators assume to be the crater of an extinct volcano. Even at this altitude the small piece of flat land is utilized and bananas are grown on it. The last stretch to the summit is very steep. It is all very damp and we frequently slip on the sodden soil. When we have finally reached the top we imagine we are in a different world. We are in the middle of a cloud forest, which, in botanical literature, is called elfin woodland and not without reason. The ground is covered with a thick carpet of ferns, among which begonias and anthuriums are frequent. The branches of the trees are thickly overgrown with moss and many branches only two inches in diameter are often 12 inches thick because of the thick lumps of moss growing on them. We find very curious ferns here with leaves less than 1/2500 inch thick, which can only grow under very damp conditions. As a result of the strong winds here on the summit the trees have all sorts of grotesque shapes, which adds to the fairytale-like effect of the forest.

6.9.'60

The Vegetation of St. Eustatius

The island of St. Eustatius forms, together with St. Maarten and Saba, the group of the Windward Islands of the Netherlands Antilles. St. Eustatius is a small island, it is only about 5½ miles long and its greatest width is only about 2½ miles.

Just like Saba, St. Eustatius belongs to the group of young volcanic formations of the Lesser Antilles and is closely related geologically to the former island. Nevertheless, it presents quite a different picture because it consists of two mountain groups connected by a plain, called the 'Plain of the Cultures'. The island was formed by volcanic action in two different periods, the northwestern part of the island arising first and the southeastern part later. The northwestern part consists of a system of hills and valleys, the remnants of what once was one volcano.

The southeastern part of the island is quite different indeed. It is almost entirely occupied by the majestic volcano The Quill, which dominates the island. The Quill, now extinct, has retained the characteristic conical shape of a volcano and is one of the finest specimens of volcano in the entire island territory of the West Indies. Its regular outline is broken only in two places, namely on the northern slope, where we find a hillock, being the remnant of a subsidiary crater, and on the south side. Here a part of the seabed was raised and deposited against the slope of the volcano at the time The Quill was still active. The raised seabed consists of coral limestone, quite a different sort of rock. It is therefore not to be wondered at that here we find plants, mainly those preferring a calcareous soil, different from those found elsewhere on the island.

Towards the summit the slopes of The Quill get very steep and in places we find perpendicular walls caused by large rocks being torn away, an indication that the process of natural destruction has already started. Erosive action by rainwater also plays a part in this process and has cut deep ravines, called guts, everywhere into the slopes. During heavy rains fast-flowing rills are formed in these guts, which cut more and more deeply into the ravines and make vegetation impossible in these places. That is why we can distinguish these guts from far away as light-brown stripes against the dark green of the forests, running down from the summit.

The northern slope of The Quill merges into a plain: the Plain of the Cultures. This plain consists of large quantities of ashes emitted by the volcano during its active period and it now rises sheer from the sea with cliffs 100–150 ft high. The rainwater has cut deep gullies here, too, which now serve as approaches. These sunken roads are characteristic of St. Eustatius and are often picturesque as a result of the varied

vegetation on the slopes. Along the west coast we find a beach at the foot of the Plain of the Cultures; here a scant beach vegetation has developed.

Like many other islands in the West Indies, St. Eustatius was planted with sugar cane in the course of the 17th century. The cultivation of sugar cane declined greatly after 1830, however, and virtually disappeared at the beginning of this century. The sugar cane was replaced by cotton, a crop which was doomed to failure when it was affected by disease. The cotton was then in its turn replaced by sisal, which remained an important export product until 1928. At present agriculture in St. Eustatius is only of local significance. Stock-breeding is also practised on a limited scale. It will be clear that these human activities have all had their influence on the vegetation of the island. In addition to very fine tropical forests we also find places with a very scant vegetation only.

Let us now turn our attention to the hilly country in the north-west. Where once there were forests we now find chiefly copses in which thorny acacias occur most frequently. A wide valley in the neighbourhood of Gilboa Hill is grown with sisal in places, the scanty remains of what once was a flourishing estate. In other valleys,

St. Eustatius: The Quill, seen from the hills in the northwestern part of the island





St. Eustatius: The tropical forest in the crater of The Quill

in which the water collects after showers, we find trees preferring moisture, remnants of an earlier forest. We find there much West Indian cherry, a shrub-like tree yielding delicious red fruit, rich in vitamin C. We further find fruit trees in places, chiefly skop apple and Kinnup trees. The undergrowth consists as a rule of a short disc-shaped cactus, not more than 12 inches high. The discs of the cacti easily break off when touched and then cling to animals or clothes with their sharp thorns. They are therefore called 'suckers'. Creepers occur rather plentifully, including the splendid passion flower, a convolvulus species with large flowers, and a very thorny shrub, called 'cockspur' by the local inhabitants. The steep slopes are generally covered by a greyish vegetation of shrubs, in which the wild sage predominates.

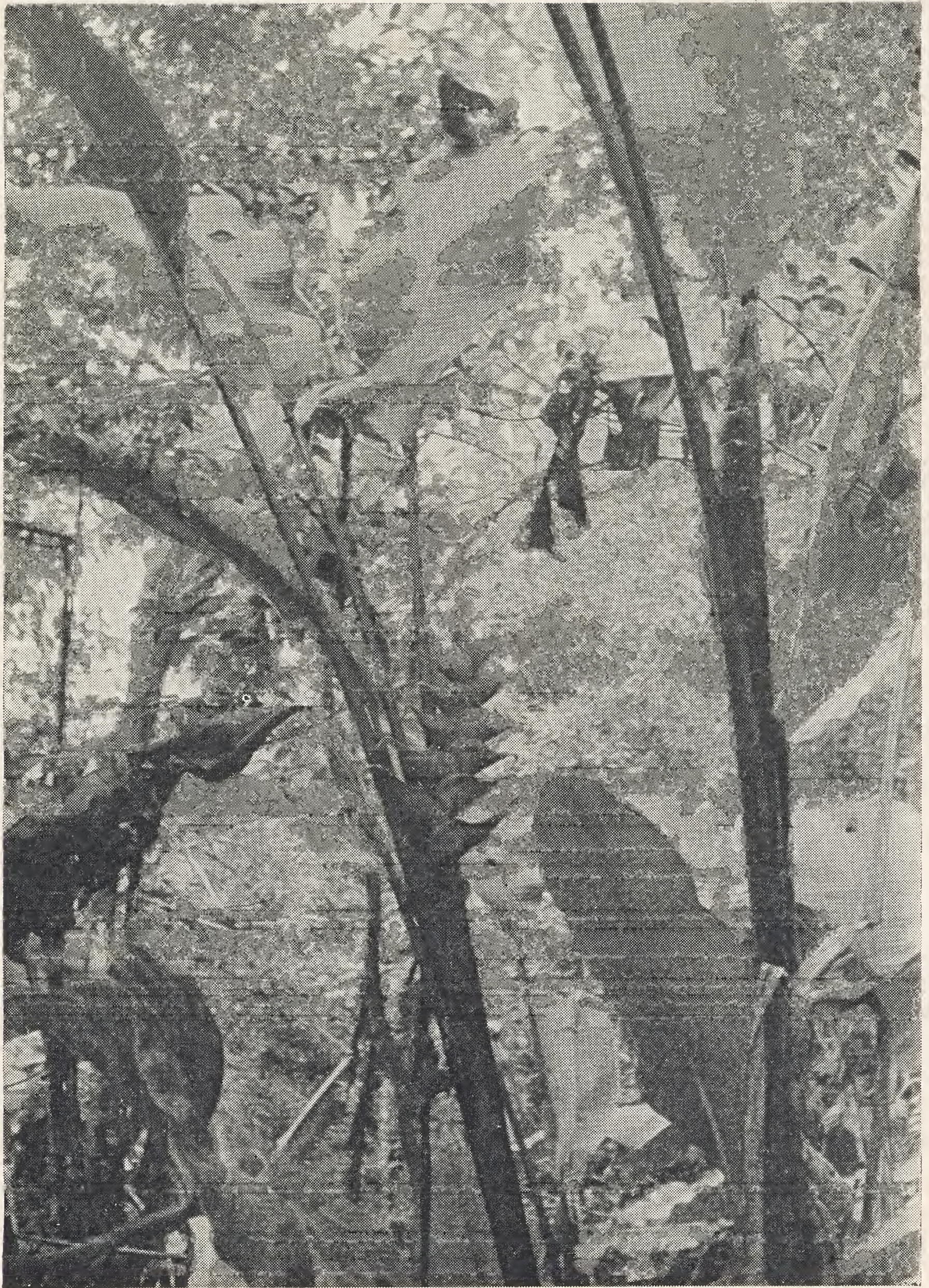
The picture presented by the northwestern flank of The Quill is quite different. Because of the greater amount of rain and because man's influence has not been so great here the slopes on this side are for the greater part densely wooded. The lower slopes are still used as arable land and pastures and here and there we see a heap of sand from which rise light-blue plumes of smoke: the places where charcoal is being burned. The path we are following is stony and rises gently. It first leads us through acacia groves interspersed with a few white cedars, tamarinds and candelabrum-shaped cacti. Along the path we find several specimens of the curious sensitive plant, the leaves of which fold together when lightly touched or quite droop down when the touch is stronger.

As we get higher the vegetation changes. The acacia groves are giving way to forest consisting mainly of trees characteristic of more humid regions: white cedar, locust tree and cotton tree. The latter has nothing to do with cotton but derives its name from its fluffy fruit. The forest is, however, far from virgin and shows signs of recent cutting, for here the trees are cut that are used for burning charcoal.

Now the path suddenly begins to climb steeply and we realize why this mountain is called 'The Quill', an English corruption of Dutch 'De Kuil', meaning 'the pit', and we arrive at the lowest point of the edge of the crater. The crater is beautifully preserved and the bottom as well as the slopes are densely wooded. We find a luxurious tropical vegetation here. In this connection it should be pointed out that tropical forests do not in general display the riot of colours people often think of when tropical virgin forests are mentioned. As a rule the flowers are not very conspicuous, with the exception of those of a number of lianas and herbs. It is rather the great variety of the shades of green and the light effects in the more open places which make the virgin forest so fascinating.

At the lowest point of the edge of the crater the forest is not very high, about 33 ft, but it is very varied. We see one or more strong lianas winding around the trees, whilst we find numerous orchids in the trees, in addition to epiphytic ferns.

It is possible to walk on the edge round the crater but it is a rather strenuous exercise since the edge is far from flat and differences in altitude of 660 ft occur. In a number of places the forest is less dense and it is precisely here that we find a wealth of herbs, with many begonias, orchids and anthuriums, in addition to many ferns. The stems of the trees and the boulders are often covered with thick layers of moss and this culminates at the crater's highest point, at a height of 1,980 ft, where



St. Eustatius: The wild banana is one of the pioneer plants in the clearings in the forest

we find an 'elfin woodland'. It is not so rich, however, as the elfin woodland at the top of Saba.

It is a wonderful experience to descend into the crater along its steep wall, scrambling over boulders and taking hold of such branches as are within reach. The bottom of the crater is rather flat, but studded with boulders, more or less circular in shape, with a diameter of 660 ft; it is grown with tropical forest consisting of dozens of different species of tree. The tallest trees found here are the cotton trees, which may become 130 ft tall and whose stems often have a diameter exceeding three and a half feet. A characteristic feature of this tree are the buttress roots which develop at its foot and radiate in star-shaped fashion so as to ensure great firmness. Numerous lianas wind along the crowns of the trees and air roots several inches thick hang from the branches.

It is disheartening to see how even the existence of these giants of the forest is threatened. Many of you will probably know the rubber plant, which is cultivated in Europa as an indoor plant. In the jungle here we find another species of this genus, a liana, which winds around the stem of a tree. It grips its victim with such force as to crush its bark, so that nutrients can no longer be transported along it and the tree in question dies. We find here a cotton tree over 100 ft high which has become the victim of this liana. The tree is dead and the foot of the stem has decayed for the greater part. But the giant tree still stands, in the grip of its strangler, which is already producing shoots reaching out for other victims. When the tree's foot has decayed further it will fall and drag with it several trees in its vicinity. In this way a clearing is made in the forest, which will be covered with vegetation again in a systematic way until such time as the jungle has fully regained its sway. Clearings are made in the forest in other ways, too. We also find those which were caused by a hurricane, which struck the island in 1928 and which felled several trees in the crater. Here the vegetation began to reassert itself already many years ago; the young vegetation consists mainly of pioneer shrubs and trees, which grow rapidly. Among them we find the wonderful wild banana. These pioneer plants will be followed by others which have a longer life.

In the beginning of the century efforts were made to cultivate crops even in the crater, so that here, too, the jungle cannot be said to be quite virgin. Cocoa trees and coffee shrubs that have run wild are silent witnesses to this. It is especially The Quill that makes St. Eustatius so attractive to naturalists and not in the last resort because of its ancient forest in the crater, where an old cotton tree has the names of several visitors inscribed in its bark, among them one dating from 1771.

30.8.'60



A

Cuba

Dominican Republic

Jamaica

Puerto Rico

Rico

Haiti

Saba

St. Eustatius

Aruba

Curacao

Bonaire

Panama

CARIBBEAN SEA

ATLANTIC

OCEAN

Venezuela

Colombia

British Guiana

Surinam

French Guiana

Guiana

Brazil

0 300 Miles

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General editor: B. Harst

